C ANALOG I/O

[Lineup]

●PCI Bus / Low Profile PCI Bus

Name	Resolution [Bit]	Channels *1			Range		Conversion Speed
		SE	DI	Output	Range	Setup	
Multi-Function A/D Boards (F series)							
ADA16-32/2(PCI)F	16	32	16	2	Input: ±10V, ±5V, ±2.5V, 0~10V, 0~5V, 0~2.5V Output: ±10V, ±5V, ±2.5V, ±1.25V, 0~10V, 0~5V, 0~2.5	Common	Input: 2µsec/ch Output: 10µsec
Intelligent A/D Boards (E series)							
AD12-16(PCI)E	12	16	8	1	Input: ±10V,±5V,±2.5V,±1.25V,0~10V,0~5V,0~2.5V,0~1.25V Output: ±10V,±5V,0~10V	Common	Input: 10µsec Output: 6µsec
AD12-16U(PCI)E	12	16	8	1	Input: ±5V, ±2.5V, 0~10V, 0~5V Output: ±10V, ±5V, 0~10V	Common	Input: 1µsec Output: 6µsec
AD12-16U(PCI)EH	12	16	8	1	Input: ±10V, ±5V, ±2.5V, 0~10V, 0~5V Output: ±10V, ±5V, 0~10V	Common	Input: 1µsec Output: 6µsec
AD16-16(PCI)E	16	16	8	1	Input: ±10V, ±5V, 0~10V, 0~5V Output: ±10V, 0~10V	Common	Input: 10µsec Output: 13µsec
AD16-16U(PCI)EH	16	16	8	1	Input: ±10V, ±5V, 0~10V, 0~5V Output: ±10V, 0~10V	Common	Input: 1µsec Output: 10µsec
Standard A/D Boards							
ADA16-8/2(LPCI)L	16	8	–	2	Input: ±10V Output: ±10V	Common	Input: 10µsec/ch Output: 10µsec
Standard Analog to Digital Input Boards							
AD16-16(LPCI)L	16	16	–	–	±10V	Common	10µsec
AD12-16(PCI)	12	16	8	–	±10V,±5V,±2.5V,±1.25V,0~10V,0~5V,0~2.5V,0~1.25V	Independent	10µsec *2
AD12-64(PCI)	12	64	32	–	±10V,±5V,±2.5V,±1.25V,0~10V,0~5V,0~2.5V,0~1.25V	Independent	10µsec *2
ADI12-16(PCI)	12	16	8	–	±10V, 0~10V, 4~20mA	Common	20µsec
ADI16-4C(PCI)	16	4	–	–	±10V, ±5V, 0~10V, 4~20mA	Independent	20µsec *2
ADI16-4L(PCI)	16	–	4	–	±1.25V, ±0.125V, 0~2.5V,0~0.25V	Independent	10µsec *2
Digital to Analog Output Boards							
DA16-4(LPCI)L	16	–	–	4	±10V	Independent	10µsec *2
DA12-4(PCI)	12	–	–	4	±10V, ±5V, 0~10V	Independent	10µsec *2
DA12-8(PCI)	12	–	–	8	±10V, ±5V, 0~10V	Independent	10µsec *2
DA12-16(PCI)	12	–	–	16	±10V, ±5V, 0~10V	Independent	10µsec *2
DA16-4(PCI)	16	–	–	4	±10V, ±5V, 0~10V, 0~20mA	Independent	20µsec *2

●PC Card

Name	Resolution [Bit]	Channels *1			Range		Conversion Speed
		SE	DI	Output	Range	Setup	
Multi-Function A/D Cards (F series)							
ADA16-32/2(CB)F	16	32	16	2	Input: ±10V Output: ±10V	Common	Input: 2µsec/ch Output: 10µsec
Standard Analog to Digital Input Cards							
AD12-8(PM)	12	8	–	2	Input: ±10V Output: 0~4.095V	Common	Input: 10µsec Output: 16µsec

●USB Series

Name	Resolution [Bit]	Channels *1			Range		Conversion Speed
		SE	DI	Output	Range	Setup	
Analog to Digital Input Modules							
ADI12-8(USB)GY	12	–	8	–	±10V, ±5V, 0~10V, 0~5V	Common	10µsec *2
Digital to Analog Output Modules							
DAI12-4(USB)GY	12	–	–	4	±10V, ±5V, 0~10V, 0~5V, 0~20mA	Common	10µsec *2

●ISA Bus

Name	Resolution [Bit]	Channels *1			Range		Conversion Speed
		SE	DI	Output	Range	Setup	
Intelligent A/D Boards (E series)							
AD12-16(PC)EH	12	16	8	1	Input: ±10V, 0~10V Output: ±5V, ±10V, 0~10V	Common	10µsec
AD12-16U(PC)EH	12	16	8	1	Input: ±5V, ±2.5V, ±10V, 0~10V, 0~5V Output: ±5V, ±10V, 0~10V	Common	1µsec
AD16-16(PC)EH	16	16	8	1	Input: ±10V, ±5V, 0~10V, 0~5V Output: ±10V, 0~10V	Common	10µsec
AD16-16U(PC)EH	16	16	8	1	Input: ±10V, ±5V, ±2.5V, 0~10V, 0~5V Output: ±10V, 0~10V	Common	1µsec
Analog to Digital Input Boards							
AD12-16(PC)	12	16	8	–	±10V, ±5V, 0~10V	Common	20µsec
AD12-8LT(PC)	12	8	–	–	±5V	Common	25µsec
AD12-16LG(PC)	12	16	–	–	±5V	Common	15µsec
ADI12-16(PC)	12	16	8	–	±10V, ±5V, 0~10V, 0~5V, 0~20mA	Common	25µsec
ADI12-8CL(PC)H	12	–	8	–	0~5V, 1~5V, 0~20mA, 4~20mA	Common	1200µsec
Digital to Analog Output Boards							
DA12-4(PC)	12	4	–	–	±10V, ±5V, 0~10V	Independent	5µsec
DA12-6LC(PC)	12	6	–	–	±10V,±5V,±2.5V, 0~10V,0~5V, 4~20mA	Independent	4µsec
DA12-8L(PC)	12	8	–	–	±10V,±5V, 0~10V, 4~20mA (1ch only)	Independent	10µsec
DAI12-4C(PC)	12	4	–	–	0~5V, 4~20mA	Independent	24µsec
DAI12-8C(PC)	12	8	–	–	0~5V, 4~20mA	Independent	24µsec
DA16-4D(PC)	16	4	–	–	±10V, 0~10V	Independent	13µsec

*1: "SE" = single-ended input / "DI" = differential input.
*2: Conversion time is speed per channel.
*3: Digital I/O and control signals are interconnected through connector CN2.
*4: Destined

Trigger (Start / Stop)			Clock		Memory	Isolation	Digital I/O	Counter Input	Connector	Software		Page	Name
Software	Digital Trigger	Level	Timer	Digital Trigger						ACX-PAC(W32)	API-PAC(W32)		
Y	Y	Y	Y	Y	Bus Master,I/O64K	–	Input: 8 Output: 8	2	96-pin Half Pitch	– *4	Included	C-07	ADA16-32/2(PCI)F
Y	Y	Y	Y	Y	I/O256K	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Included	C-10	AD12-16(PCI)E
Y	Y	Y	Y	Y	I/O16M	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Included	C-10	AD12-16U(PCI)E
Y	Y	Y	Y	Y	I/O16M	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Included	C-09	AD12-16U(PCI)EH
Y	Y	Y	Y	Y	I/O256K	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Included	C-10	AD16-16(PCI)E
Y	Y	Y	Y	Y	I/O16M	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Included	C-09	AD16-16U(PCI)EH
Y	Y	–	Y	Y	1k Word	–	Input: 4 Output: 4	1	50-pin Heade	– *4	Included	C-10	ADA16-8/2(LPCI)L
Y	Y	–	Y	Y	1k Word	–	Input: 4, Output: 4	1	50-pin Heade	– *4	Included	C-12	AD16-16(LPCI)L
Y	–	–	Y	Y	–	–	Input: 4, Output: 4	–	96-pin Half Pitch	Y	Included	C-12	AD12-16(PCI)
Y	–	–	Y	Y	–	–	Input: 4, Output: 4	–	96-pin Half Pitch	Y	Included	C-12	AD12-64(PCI)
Y	Y	Y	Y	Y	I/O256K	Bus	Input: 4, Output: 4	–	36-pin D-type	Y	Included	C-13	ADI12-16(PCI)
Y	–	–	Y	Y	–	Bus / Channel	–	–	37-pin D-type	Y	Included	C-13	ADI16-4C(PCI)
Y	–	–	Y	Y	–	Bus / Channel	–	–	37-pin D-type	Y	Included	C-13	ADI16-4L(PCI)
Y	Y	–	Y	Y	1k Word	–	Input: 4, Output: 4	1	50-pin Heade	– *4	Included	C-12	DA16-4(LPCI)L
Y	–	–	Y	Y	–	–		–	37-pin D-type	Y	Included	C-14	DA12-4(PCI)
Y	–	–	Y	Y	–	–	–	–	37-pin D-type	Y	Included	C-14	DA12-8(PCI)
Y	–	–	Y	Y	–	–	–	–	37-pin D-type	Y	Included	C-14	DA12-16(PCI)
Y	–	–	Y	Y	–	Bus / Channel	–	–	37-pin D-type	Y	Included	C-14	DA16-4(PCI)

Trigger (Start / Stop)			Clock		Memory	Isolation	Digital I/O	Counter Input	Connector	Software		Page	Name
Software	Digital Trigger	Level	Timer	Digital Trigger						ACX-PAC(W32)	API-PAC(W32)		
Y	Y	Y	Y	Y	Bus Master,I/O64K	–	Input: 4 Output: 4	1	96-pin Half Pitch	– *4	Included	C-07	ADA16-32/2(CB)F
Y	–	–	Y	Y	I/O16K	–	Input: 4 Output: 4	–	37-pin D-type	Y	Included	C-15	AD12-8(PM)

Trigger (Start / Stop)			Clock		Memory	Isolation	Digital I/O	Counter Input	Connector	Software		Page	Name
Software	Digital Trigger	Level	Timer	Digital Trigger						ACX-PAC(W32)	API-PAC(W32)		
Y	–	–	Y	Y	–	Bus	–	–	12-pin Screwless Connector x 2	Y	Included	C-15	ADI12-8(USB)GY
Y	–	–	–	–	–	Bus	–	–	12-pin Screwless Connector x 2	Y	Included	C-15	DAI12-4(USB)GY

Trigger (Start / Stop)			Clock		Memory	Isolation	Digital I/O	Counter Input	Connector	Software		Page	Name
Software	Digital Trigger	Level	Timer	Digital Trigger						ACX-PAC(W32)	API-PAC(W32)		
Y	Y	Y	Y	Y	I/O256K	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Y	C-11	AD12-16(PC)EH
Y	Y	Y	Y	Y	I/O256K	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Y	C-11	AD12-16U(PC)EH
Y	Y	Y	Y	Y	I/O256K	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Y	C-11	AD16-16(PC)EH
Y	Y	Y	Y	Y	I/O256K	–	Input: 4 Output: 4	–	37-pin D-type *3	Y	Y	C-11	AD16-16U(PC)EH
Y	Y	–	Y	–	–	–	Input: 1, Output: 1	–	37-pin D-type	Y	Y	C-17	AD12-16(PC)
Y	Y	–	Y	–	–	–	Input: 3, Output: 4	–	37-pin D-type	Y	Y	C-17	AD12-8LT(PC)
Y	Y	–	Y	–	–	–	Input: 8, Output: 8	–	37-pin D-type	Y	Y	C-17	AD12-16LG(PC)
Y	Y	–	–	–	–	Bus	Input: 2, Output: 4	–	37-pin D-type	Y	Y	C-17	ADI12-16(PC)
Y	Y	–	–	–	–	Bus / Channel	Input: 2, Output: 4	–	37-pin D-type	Y	Y	C-17	ADI12-8CL(PC)H
Y	Y	–	Y	–	–	–	Input: 1, Output: 1	–	37-pin D-type	Y	Y	C-18	DA12-4(PC)
Y	–	–	–	–	–	–	24 Bi-directional	–	37-pin D-type	Y	Y	C-18	DA12-6LC(PC)
Y	–	–	–	–	–	–	Input: 4, Output: 4	–	37-pin D-type	Y	Y	C-18	DA12-8L(PC)
Y	–	–	–	–	–	Bus	Input: 2, Output: 4	–	37-pin D-type	Y	Y	C-19	DAI12-4C(PC)
Y	–	–	–	–	–	Bus	Input: 2, Output: 4	–	37-pin D-type	Y	Y	C-19	DAI12-8C(PC)
Y	–	–	–	–	–	–	–	–	37-pin D-type	–	–	C-20	DA16-4D(PC)

Types of Analog I/O Boards

1. Definition

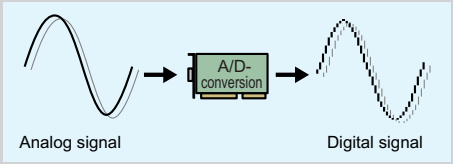
Analog I/O Boards allow an analog signal to be generated by a personal computer through the conversion of digital signals. External machinery can be monitored by the reverse - converting the analog output into digital signals that can be interpretated by a personal computer.

2. Types and applications

Analog Input Boards

These boards provide Analog to Digital conversion. They are used for computer-based monitoring of external devices that utilize sensors (i.e. temperature or pressure)

CONTEC manufactures different styles of analog devices and classifies themaccording to their functions.

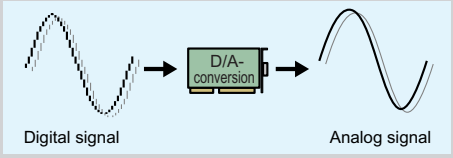


●Standard
These provide basic analog to digital conversion with 12 or 16 bit resolution and a range af available channels.
They are available for PCI, ISA, PC Card or USB interconnection.

●Intelligent (CONTEC's E series)
Highly specialized, providing sampling control and mass memory, these boards can be adapted for a variety of suitable applications. Features include simultaneous sampling, gain amplifiers, low path filters and isolated amplifiers.

Analog Output Boards

These provide digital to analog conversion and are used when connecting external actuators or voltage / current controlled machinery directly to a host computer.



3. Function(1/2)

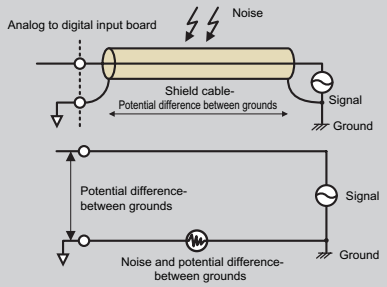
Input / Output channels

In determining the number of channels needed, both the sensor or source of a signal and the number of actuators must be taken into consideration. In addition, there are two wiring methods (single-end and differential) that can be used with these boards.

●Single end
Single-end connections use 2 lines - signal and ground. They then measure the voltage of the signal source.
(See figure below)

Advantages
- Requires only two lines for one signal source
- Allows two times more channels per board than differential

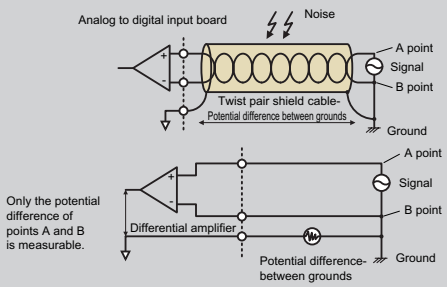
Disadvantages
- Measurement results can be skewed by the potential difference between grounds
- Signal is easily influenced by external electrical noise.



Differential input
Differential connections use a total of three lines - two signal and one ground.The signal source voltage is monitored through differences in ground potential, point potential, ground and point B measurements and the signal source potential. (See figure below)

Advantages
- Potential difference between ground signal source doesn't influence the measurement results.
- Measurement results are not easily influenced by external electrical noise.

Disadvantages
- Requires three lines for one signal source.
- Allows only half as many channels as single-ended input



Input / Output range

The voltage or current range that can be used with a board.

●Range
Identifies the possible parameters for input / output selection. For accuracy these must be as close as possible to the range a sensor or actuator needs.

●Setting
Available input / output range setting options:

Communal: All channels are set to a common input / output range
Independent: A separate input / output range can be set for each channel.

3. Functions (2/2)

Resolution

Analog input resolution indicates to what extent approximation (quantization) of the signal can be achieved whereas analog output resolution indicates to what extent data (digital signals) can be expressed as analog signals. Correspondent performance is as follows -

12 bit (general purpose I/O): a possible 2^{12}(4096) resolution - i.e. with an input range of 0 to 10V, 10/4096 → approx.2.44mV minimum unit.
16 bit (high precision type): a possible 2^{16}(65536) resolution - i.e. with an input range of 0 to 10V, 10/65536 → approx.0.15mV minimum unit.

* "Conversion precision" indicates the rate of possibe error

Conversion speed

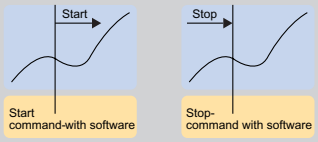
Analog input conversion speed is the time neccessary for input voltage or current to be converted into data (digital signals). Analog output conversion speed is the time required before voltage or current specified by the data (digital signals) can be output. The true minimum clock speed is affected by a variety of factors including operating system, drivers and firmware processing. Boards with onboard memory, deliver high speed input/output without being affected by background processing.

Trigger

A variety of control conditions for setting the start/stop of the signal conversion are possible

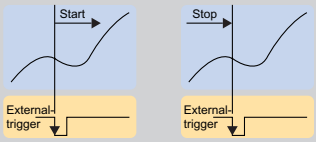
Soft

Start/stop controlled by software.



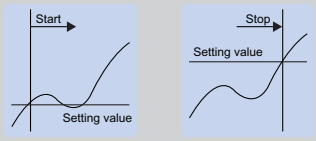
External

Start/Stop controlled via external (digital) signals



Level

Start/Stop controlled by signal change of a specified channel. (Each condition can be set.)

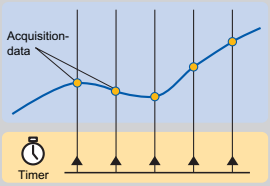


Clock

Timings available for synchronizing the signal conversion

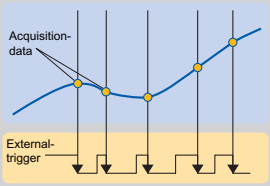
Internal

Essential for time series processing. An onboard cycle setting timer enables synchronization of data conversion to the timer pattern



External

Essential for synchronizing with an external device. An external clock input terminal allows conversion to be done in synch with external pulse signals.



Memory

Type and capacity of on-board memory.

[I/O]

Capable of automatically storing (outputting) sampling data in synch with the clock onto onboard memory. This enables high speed operation independent of the host computer's processing capacity. The memory can be set to either FIFO or ring.
With 256K memory capacity, it is possible to store 256 x 1024 or 262,144 data words. (with 16 channels, the data which can be stored will be 262,144 / 16 or 16,384 per

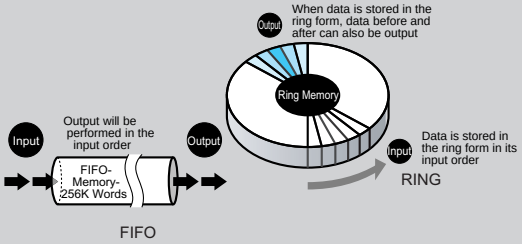
[Bus master]

Direct transfer of data to or from the host computer's memory with no additional load on the computer's CPU. A maximum of 64MB memory can be secured.

Even when the memory capacity is exceeded, the signal can be continually sampled, without interruption, by a consecutive read of the input data during the sampling.

With I/O format, data can be easily read in FIFO format.

When the total time required for data read-out, file saving, display, etc. exceeds the time before the memory is full, an overflow error will occur. In that case, it will be necessary to delay the clock. The minimum clock neccessary for continuous sampling will vary depending on the number of channels and the speed of both the CPU and the hard disk.

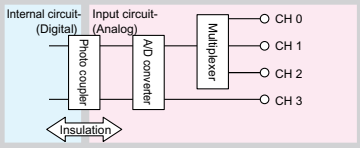


Insulation

Built-in circuit insulation

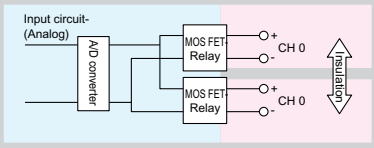
Bus

Insulates the host computer and the external input/output circuit by using a photo coupler and isolation amplifier. By blocking electrical disturbance, it is suited for use in applications where noise is likely to cause interference or when the computer is susceptible to malfunction or damage.



Channel

Independent input/output channel insulation using photo couplers and isolation amplifiers to prevent channel-to-channel interference. It is suited for use in applications where connected devices have different ground levels.



Features of CONTEC's F series

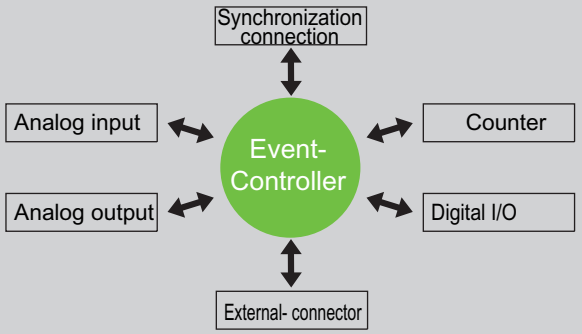
1. Multi-function

Analog input / output, digital input / output and counter functions, for computers with limited numbers of expansion slots to be used in configuring complicated systems.

2. Event controller for diverse sampling control

Provides central management (via hardware) for start/stop/clock control of analog input/output operations. Easily combines event functions and external control signal inputs for high level synchronous control that is independent of controlling software. Individual operation of each function is also possible.

Description of event controller



Arrows indicate the flow of control signals.
Major control signals include operation start, operation stop and clock signals.

Ex.1: Conducting both analog input and analog output with the same timing using external clock signals

Ex.2. Starting the analog input operation each time the counter reading reaches a specified value

3. Bus master transfer and complex data input

Both analog input and output utilize bus master transfer (either individually or concurrently), allowing bulk data transfer between the host computer and the board with no additional load on the CPU. Simultaneous transfer is available for data using bus master transfer (analog & digital input, digital output and count data) if they are synchronized with the analog input clock signals. This function enables synchronization between various data in the system.

4. Buffer memory for software independent background processing

Both analog input and output feature onboard buffer memory for use when bus master transfer is not used. This function allows input/output in be performed in the background without depending on system operation status of either the host computer or the software.

5. Setup and adjustment performed via software

Setup and adjustment, such as those concerning the range of analog input and output is done via software, eliminating the need to change jumper settings. It can also recognize any adjustment information that is different from that set at the factory. This allows for optimum settings for individual applications.
Note: software range setting available only on PCI boards

6. Synchronous control connector (ADA16-32/2(PCI)F)

CONTEC's ADA16-32/2(PCI)F is equipped with a synchronous control connector capable of synchronizing control of multiple boards, enabling channel through a increase of the number of boards.
This synchronous operation is easily configured.

7. Filtering for facilitation in the connection of external signals

External analog input/output, digital input/output and counter input/output are equipped with a digital filter for the prevention of chatter.

Product Lineup / Basic Knowledge
F Series Multi-Function I/O
Features
PCI
PC Card
E Series Intelligent I/O
Features
PCI
ISA
Standard I/O
Low Profile PCI / PCI
PC Card
USB
ISA